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SOME BINOCULAR IMBALANCES AND THEIR TREATMENT

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Four years ago I became interested in the treatment of the various forms of binocular imbalances. The large number of cases of eyestrain that are not relieved by the wearing of glasses are caused mostly by some form of such defect. Until that time, while in theory we knew what should be done, we were at a loss for suitable and convenient instrumental equipment to accomplish our objective; so I began to study and use a Kratometer and I desire to tell you something about this work and its results.

In the four years referred to we have treated three hundred and eighty-five cases of pronounced binocular imbalance. These cases include the following types of disturbances:

1. Inability to secure convergence relaxation. These are cases in which it is necessary to increase the amount and speed of abduction in the esophorias. Headache is an almost constant symptom in these cases and the relief is prompt and positive.

2. Cases of convergence insufficiency due to hypo-tonicity of internal recti muscles. These are cases of high exophoria due to exhaustion of accommodation, correction of hyperopia, or to general fatigue or to mental indifference. The great majority of our cases belong in this group of convergence insufficiencies. There are four serious reflex sequelae, one or more of which present themselves in these cases. They are (1) headache of some form or dizziness or both, as a local symptom. (2) Nervous indigestion, due of course to faulty gastric innervation caused by the waste of nervous energy on the eyes. (3) Increased temperamental irritability, felt keenly even though successfully concealed. (4) Excessive fatigue varying in proportion to the amount of near vision work done.

The promptness with which these symptoms disappear as treatment progresses is truly gratifying to the physician as well as to the patient. The exact cause of the exophoria must be carefully diagnosed because of differences in treatment. When it is realized that the eyes make literally thousands of convergence angles every day—each

one exactly suited to the distance from the plane of the eyes to the object of regard, and that any failure results in a loss of perfect binocular vision, it will be at once apparent that disturbance of this function can be serious and far-reaching in its evil consequences. Another reason for this is the absolute imperativeness of single vision; for just as long as it is within the capacity of the nervous system to honor the draft that the eyes make upon it in this matter of overcoming a diplopia, it will be done, and herein lies the great danger and the cause of most of the reflex sequelae.

3. Cases of arrested development of the convergence-accommodation function. These cases usually show good accommodation power but very little and sluggish convergence. The normal relationship of these two important functions by which we secure a certain amount of convergence effect as a sort of by-product of the accommodative act does not exist, and therefore it is a technical error to prescribe a plus correction for near work, since this only increases the convergence difficulty and gives help just where it is not needed. Many young people doing much near work suffer from this form of eye-strain. Too many of these have had reading glasses fitted much as if they were presbyopes and therefore had no accommodation power. Rational treatment requires the restoration of their convergence power and the establishment of their normal convergence-accommodation relationship. It will be clear, that not only with these cases but also with those that have a fairly good convergence power, it is a serious mistake to prescribe, say a pair of plus 1.00 lenses to be used for reading. These are the cases wherein we gain some reputation among the laity by restoring convergence and throwing away the glasses. The facts pertaining to this group of cases have been seized upon by the self-styled "eye-strain" specialists as the justification for their blatant publicity which says: "Throw away your glasses. Eye glasses are not necessary to the average man or woman now wearing them. They can be discarded with joy and comfort if you will strengthen your eyes through our new course of eye training." One of the unfortunate things in connection with this matter is that we, of the medical profession are culpable as parties to this deceit because, instead of sending our cases in need of such care to qualified members of the medical and optometric professions, we permit them to drift into the hands of these unintelligent or designing grafters. Of course, it happens that many people are wearing glasses who should not have them, having gone to someone who just had glasses to sell and the inevitable result followed. These cases add to the fakers' reputation, the patients being the victims of both ends of the game, paying out good money in the first place for glasses they should never have worn and later paying out more good money to have the worthless things taken off.

4. Cases in which, as a result of toxic conditions from acute infectious disease or chronic foci of infection, or exhaustion states in cases of high blood pressure, or the inanition of profound malnutri-

tion, associated control of the muscles and nerve centers upon which binocular vision depends is lost.

These cases are made very happy and comfortable during their convalescence by innervational ocular exercises.

Now, of course, these four classes of cases do not represent all the types of binocular imbalances that there are, but they are probably the most important from the standpoint of amenability to treatment and certainly are representative of the work that has engaged my own attention most. Lately I have been studying the troublesome symptom of dizziness and there are some very interesting observations to be made. It looks as if dizziness is sometimes caused by delay in transmission of the visual impulse as compared with that of the vestibular sensations, as for example, when rapid changes are made in the posture and positions of the body and head. At any rate in two cases of very severe vertigo with no labyrinthine disturbances the dizziness ceased as soon as binocular balance was well etablished and high speed given to the fusions. These cases have been kept under very careful observation for a period of more than two and a half years and there have been no recurrences. There are no doubt many other symptoms which, if well understood, would be just as amenable to treatment as this form of dizziness. Undoubtedly we shall discover new and valuable uses for an instrument constructed on the principle of the Kratometer, and as experience accumulates it will find its way into the literature for the benefit of all who undertake this work.

Now, just a word or two about the rationale of Kratometer treatments. We know that the areas whose stimulation induces fusional efforts are in those parts surrounding the maculae, not in the the maculae themselves. If these areas have lost their normal sensitiveness and their stimulation does not set in motion the reflex mechanism that normally brings about bi-macular fixation and thus fusion, diplopia results. Under these conditions and irrespective of whether the diplopia is slight or marked as long as single binocular vision can be secured it will be done no matter at what expense of neural energy; and failing this there will supervene either suppression, suspension, alternate fixation, or such pronounced squint that all strain ceases and there is obvious divergence. It is to be remembered that in such conditions we are confronted with loss of innervational responsiveness rather than with hypo-tonicities of extra-ocular muscles as was formerly so generally believed.

Now the Kratometer is provided with batteries of prisms arranged in reels and slides in such fashion that images may be suddenly "jumped" out of fusion separating them by one, two, three, five, or ten prism diopters at a time, arousing the fusional impulse with a sharp quick stimulus. Muscular action is in proportion to the vividness of the sensory impression, and it is said that a "jumping object attracts more than double the attention that a gliding object

attracts." Development of normal reactions follows the ordinary laws of habit formation. After an accurate diagnosis has been made the precise function that is to be restored is apparent. If there is favorable response to the use of the preferred stimulus, treatment will be successful, for according to the law of habit formation response to a given stimulus having taken place it will take place upon subsequent application of the stimulus with less difficulty. All that is then necessary is a sufficient number of repetitions of the stimulus to insure the desired degree of development.

It might seem from this admittedly inadequate outline that the work is altogether simple, but such is not the case. These four years have been four years of hard work on my part. The 385 cases have given me much experience and of course new insights. It seems to me that I have been compelled to know more of physiology than has been required in any other phase of medical practice which I have essayed. The amount of manual training necessary to develop proper skill in instrumentation is considerable. To the extent that the detailed work is educational in character I enjoy it because of personal idiosyncracies. The selection and training of assistants is another matter requiring some care. In this I think I have been successful. The greatest difficulty for me, as is the case in all fields of medicine, has been in making the diagnosis. Diagnosis is tedious, difficult, long drawn-out work—much more difficult I think than the diagnosis and measurement of errors of refraction, but the interest seems to be proportional to the difficulty.

The securing and maintaining of efficient comfortable vision is far more than an optical thing. Certainly in many cases the fitting of the satisfactory lenses for the correction of errors of refraction becomes a minor problem. The major problem is physiological and psychological.

To summarize briefly:

1. The older methods of treating binocular imbalances were not satisfactory, and the idea still held by many that all that is necessary is to accurately correct the errors of refraction should be abandoned in all except the imbalances of very low degree.

2. The difficulties experienced with all other forms of prism treatments are overcome by the use of the Kratometer because of its conformity to the physiological principles underlying binocular fixation.

3. The symptoms complained of by those in need of binocular training are: headache, dizziness, nervous indigestion, increased temperamental irritability, fatigue, sleepiness when the patient wants to be awake and sleeplessness when it is not wanted, car-sickness, panoramic headache, shopping headache, movie headache.

4. When there are no other causes of the symptoms complained of than the binocular imbalances the treatment is eminently satisfactory.

5. The most serious drawback is the amount of time consumed in the work. Further, and this one hesitates to mention, the people have not been educated up to the point that they are willing to pay an adequate fee for the time spent in treatment and the skill and time spent in the making of the diagnosis, such as they have been trained to do in surgery. These desirable results will no doubt come with the development that inevitably takes place when a new and valuable agency is honestly used in the treatment of the sick.

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HEREDITY NOT AN ACTIVE FACTOR IN THE TRANSMISSION OF REFRACTIVE ERRORS

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Periodically, articles appear in various optometric publications, dealing with the theory that refractive errors are hereditary. While none have gone so far as to state that all refractive errors are inherited, a few have inferred it. It is an interesting theory and well merits the consideration of the optometrist. Unfortunately there are no statistics covering a large number of cases and so the reasoning has been based on specific, and possibly exceptional, cases. This, I believe, is an error. All that can be assumed from such isolated cases is not conclusive proof.

The purpose of this article is not to disparage or even to contradict the statements made by other men in behalf of the theory. It is merely to express the doubt, as to the correctness of the theory, that lies in the writer's mind and to set forth the reasons for this doubt. Let it be understood that this is in no way an attempt to prove that some refractive errors are not inherited. The writer admits that there are any number of cases in which the theory apparently is correct. He also believes that the majority of cases does not bare this theory out.

Probably, we as optometrists think too much in terms of diopters. A hyperopia of three diopters is worthy of consideration. However, if we convert three diopters into lineal dimensions and consider it as the deficiency in focal length it is rather small. If we represent it in terms of the radius of curvature of the cornea, it becomes a little less than one-half millimeter. If we accept the theory of hereditary refractive errors, we are forced to assume that we inherit our parents' dimensions to the fraction of a millimeter. It is an accepted fact that we do not inherit our parental measurements as accurately as this in any other organ, nor in the body as a whole. Does it seem probable that the eye is so outstanding an exception?

To continue, pointing out weak spots in the theory, what law do refractive errors follow? Certainly not the law of Mendel. It is easy to apply that law to black rabbits and white rabbits, but it does not explain difference in size. Neither will explain difference in ocular dimensions. So far the writer has never seen any law of heredity which could be made to apply, even remotely, to refractive errors. Neither has he seen any physiological process, either pre or post natal, that would allow for the explanation of refractive errors on a hereditary basis. This all makes for skepticism.

There is an aspect of refractive errors, which seems to have been overlooked. The development of the eye, which goes on from birth to an age well into adolescence must be a governing factor in refractive errors. This needs a little explanation. All normal babies are hyperopic. Such as the writer has been able to observe, have been hyperopic to a considerable degree; none under three or four diopters. Most children show a fair amount of hyperopia up to the ninth year. Now let us consider the adult. The average error of maturity is comparatively low. Of the population, thirty per cent are practically emmetropic. The other seventy per cent show an average error of less than two diopters. The average error in the first hundred cases picked at random from the writer's files was 1.63. Remember that about ten per cent of these are myopic. All this tends to show that between the date of birth and the age of maturity there is a lowering of the hyperopia with which we are born.

The question arises as to where this hyperopia is lost. The eye of the new born babe is probably about seventeen millimeters in length as against the twenty-four of the adult. Axenfeld and Holth both found that the curvature of the cornea was about the same in babes and adults, with a tendency for the former to be of greater curvature. Stadfeldt compiled figures showing that the lens in the babe has a refractive value of nearly twice that of the adult. From these facts we can see where the development actually takes place. Since cornea is about the same in babes and adults, we may eliminate that as a factor. The length of the eyeball increases and the strength of the lens decreases. Apparently the length does not increase at a rate exactly corresponding to the development of the lens. Consequently, if the length increases too rapidly we have myopia. If it does not increase rapidly enough we have some hyperopia left.

To the reader, who may possibly be unfamiliar with this theory, it may seem far-fetched. However, consider that we have ample proof of this development. At least it seems more logical to explain refractive errors on the basis of this development than to assume that we inherit our parental dimensions to the fraction of a millimeter.

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THE SPECTRUM

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All matter is made up of minute particles which are in a constant state of motion within it. These small particles are known as "Electrons." A molecule, for illustration, is made up of two or more atoms; the atoms in turn are made up of two or more electrons. Taking the present day view of the atomic structure of matter it is easy to understand that the difference between one element and another (iron and lead, e. g.) lies only in the arrangement and number of electrons which form its atoms. The lightest known atom, hydrogen gas, possesses one positive electron around which a negative electron is in constant motion much the same as many of our celestial bodies revolve around others in a fixed orb or circle.

These electrons are in constant and rapid motion, the speed of which is increased as the temperature of the piece of iron is raised and are constantly "bombarding" the surrounding space and giving off energy which we call "radiant energy." All bodies, except those at a temperature of absolute zero (460 degrees below zero F.), are constant radiators of energy in one form or another.

When the piece of iron is of 70 degrees temperature and is situated in a medium of the same temperature the amount of radiated and absorbed energy are said to be equal. When the iron is warmer than the surrounding media it radiates heat; if the temperature of the iron is sufficiently high it radiates heat and light; and if its temperature is very high it radiates heat, light and ultra-violet rays (hereinafter referred to as U-V), and under proper conditions the piece of iron may conduct an electric current, radiate radio waves and heat, light and U-V rays all at the same time.

The term "Light" refers only to that portion of radiant energy of the spectrum which is visible to the eye. The remaining energy is sometimes spoken of as "invisible light" although this latter term correctly applies only to those rays which are just above or just below the visible area. When one speaks of "The Spectrum" we unconsciously think of the VISIBLE spectrum which is the only one we have ever "seen." The spectrum of radiant energy, however, covers a very much wider range, only a very small part of it being visible to the eye.

Radiant Energy is usually taken to include heat, light and U-V rays. However, the Hertzian (radio) rays and commercial alternating current electricity are also forms of radiant energy, the difference being merely in "frequency" or "wave-length" so that for the pur-

poses of comparison we have included them here. The most interesting point in comparing these different forms of radiant energy is that they all travel at the same rate of speed and are all of an "electronic" nature.

The presently accepted theory of the character of electricity is called the electron theory. It holds that electricity consists of moving electrons and that an atom of any element, no matter how widely matter may vary in its chemical or physical make-up (such as iron and oxygen) is made of two parts; a neucleus which is "positively" charged and which is surrounded by one or more electrons "negatively" charged and which constantly revolve around the central positive neucleus. Thus when a body under favorable conditions loses some of its moving negative electrons it becomes "positively" charged and when a body has acquired more than its usual number of moving electrons it becomes "negatively" charged.

Because of the fact that electricity is of such a "low grade" form of radiant energy that it requires a path to be constructed for it to travel upon it is not often included in references to radiant energy which term is usually taken to include only those forms capable of transmitting themselves through a considerable space. On the other hand, electricity in commercial form will travel over but a short space when a flame, arc, or "sparking" occurs. With the use of modern equipment electricity may be easily converted into the higher frequencies of the spectrum with the exception, perhaps, of the extreme U-V the source of which is not yet determined.

The process of converting the higher frequencies, such as light, into the lower frequencies of the spectrum is much more difficult probably due to the greatly reduced intensity of the shorter waves.

Starting at the bottom of the spectrum, then we have alternating current electricity of which we mentioned before. This is of a very slow frequency. The 25 cycle alternating current used commercially for power purposes is too slow for satisfactory lighting but travels over long lines with a little less loss than the 60 cycle current which is used generally for both power and lighting purposes. In a few locations 135 cycle current may be found where it is used for lighting only and was formerly more widely used than at present.

The wave length of a 25 cycle wave is 7,452 miles.
The wave length of a 60 cycle wave is 3,088 miles.
The wave length of a 135 cycle wave is 1,372 miles.

An interesting feature of this current is that it travels only at (or near) the surface of the conductor and for this reason wires made up of several smaller wires grouped together or "stranded" are often used because of their greater efficiency and tensile strength. This pecularity is known as the "skin effect." That such current has a tendency to get entirely away from the surface of the conductor and pervade the surrounding atmosphere for a short distance

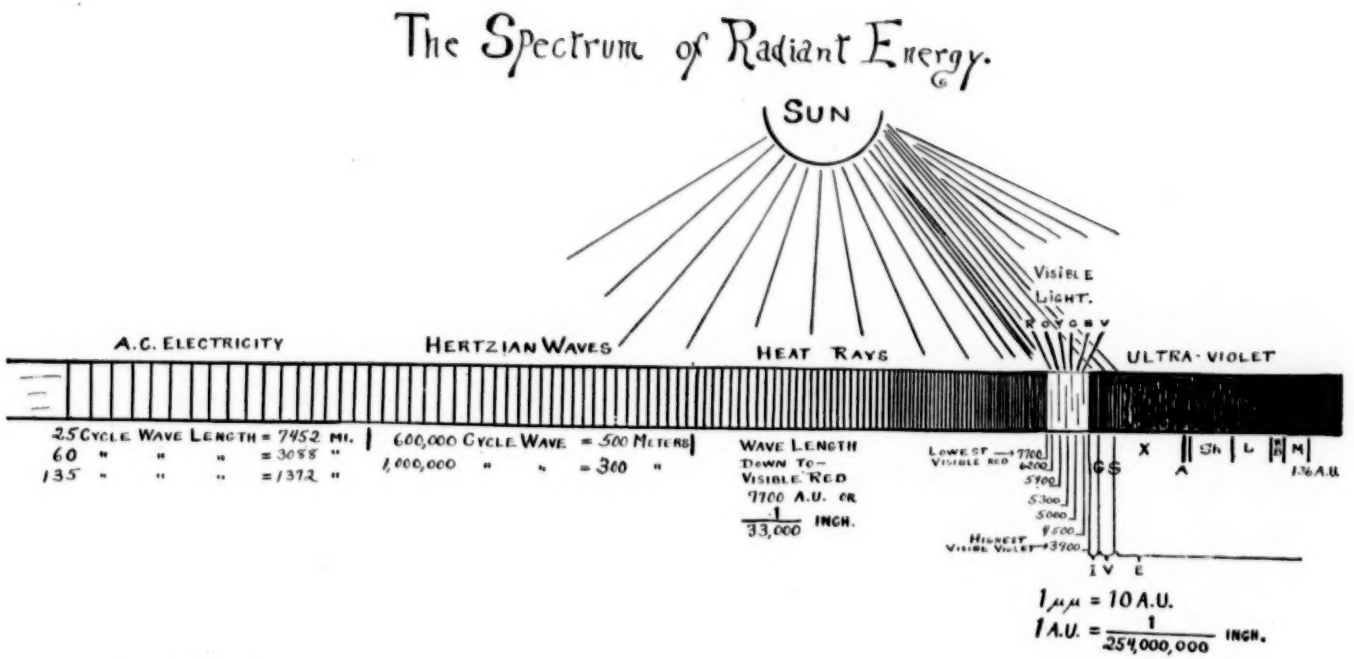
The Spectrum of Radiant Energy.
SUN
Visible Light.
ROYGBV
A.C. ELECTRICITY
HERTZIAN WAVES
HEAT RAYS
ULTRA-VIOLET
25 CYCLE WAVE LENGTH = 7452 MI.
60 " " " = 3088 "
135 " " " = 1372 "
600,000 CYCLE WAVE = 500 METERS
1,000,000 " " = 300 "
WAVE LENGTH DOWN TO— VISIBLE RED 7700 A.U. OR 1/33,000 INCH.
LOWEST VISIBLE RED → 7700
6200
5900
5300
5000
4500
HIGHEST VISIBLE VIOLET → 3900
G S
X
A
Sh
L
N
M
136 A.U.
I V E
1 μμ = 10 A.U.
1 A.U. = 1/254,000,000 INCH.

Figure One

is often observed. Many interesting pieces of electrical equipment depend upon this peculiarity for their operation.

As the frequency of vibrations per second is increased this tendency of the current to leave the conductor and go off into space is increased and when the frequency reaches the point that a wire is no longer needed for its conduction and the current travels off through space at the same rate of speed which it formerly travelled the conductor we have "Hertzian" waves; named after the man who discovered them, Hertz.

Hertzian waves are our everyday radio waves and they usually are used in frequencies of from 550,000 cycles to 1,500,000 cycles per second. The wave length of any frequency can be obtained by computing it from the speed of transmission which is 185,300 miles per second. Thus 600,000 cycle radio waves (600 "kilocycles") are measured by dividing 185,300 miles (about 300,000,000 meters) by 600,000 giving their wave length as approximately 500 meters.

But the common generators of both electricity and radio waves are well known so we omit reference to them here. None of them are 100% efficient and the process of generating them is always accompanied by heat and often light as well. Diathermy sets, cathode and X-ray tubes give off radio, heat, light and U-V rays. Even our familiar gas-filled incandescent lamp gives off about 95% of its energy as heat, about 4% of its energy as useful light and less than 1% as near U-V rays.

Just where the radio waves leave off and the heat rays begin is difficult to say, they are so closely related. The infra-red rays are sometimes said to begin at 15,000 A. U. These rays were used in the world war for signalling purposes because they were invisible but could be rendered visible by suitable detectors. These heat rays also have something of a therapeutic effect because they enter further into the body and can be "focalized" near the desired area.

As the frequency increases still higher we get visible light which is composed of about 180 different hues but so blended together that seven colors predominate. Here the frequency has increased to so great an extent that the rays are no longer measured by their frequency (vibrations per second) but by their wave length (the distance from the crest of one wave to the crest of the next wave). For instance, the frequency of vibrations of red light is about 40 trillion times per second so that for these and shorter waves we use the term Angstrom Units (A. U.). The size of an Angstrom Unit can be more easily judged if we put it this way—

One meter equals 1,000 millimeters.
One millimeter equals 1,000 microns.
One micron equals 1,000 millimicrons.
One millimicron (uu or Mu) equals 10 Angstrom Units (A. U.)
One A. U. equals about 1/254,000,000ths of an inch.
The lowest visible waves of red are about 7,700 A. U.

The waves of orange are about 6,200 A. U.
The waves of yellow are about 5,900 A. U.
The waves of green are about 5,300 A. U.
The waves of blue are about 5,000 A. U.
The highest visible waves of violet are about 3,900 A. U.

Just beyond the visible violet we have a short range of U-V shown in the spectrum sketch as "I" which are spoken of as "Intra-Vital" meaning they are not essential to growth. Farther up the spectrum is a band noted as "V" which are the VITAL rays and beyond these are the extra-vital U-V rays as shown at "E."

Among these latter U-V rays are the X-rays, marked "X," and this section is also occupied by a large portion of the radiation of radium. The line noted as "A" marks the limit of transmission of radiant energy by the atmosphere; the line "G" marks the limit of transmission of ordinary window and spectacle glass and the line "S" marks the limit of solar radiation reaching the earth.

As we go farther up the spectrum we find at "Sh" a group of rays known as the Shuman rays; then comes the Lyman zone at "L" followed by shorter rays found by Richardson and Bazzoni at "RB" and up to the "cosmic" rays of Millikan, the shortest rays yet discovered. Millikan has measured rays down to 136 A. U. or about 1/756,000ths of an inch. How far "up" or how far "down" the spectrum other waves may go we cannot presume to tell here.

Much of the violet and U-V is absorbed by the earth's atmosphere which accounts for the blue of the sky as well as for the fact that the amount of U-V rays is greater at higher altitudes. It is apparent that the energy from the sun loses little if anything in coming through the 92 million miles of interstellar space which consumes about 8¼ minutes' time. We might also mention here the recent accepted belief that the "smothering" action of the sun's energy accounts for the fact that radio reception at noon is about one-tenth that at midnight.

The sun is, of course, the chief seat of radiation in Nature and is essential to nearly all living matter. The Ancients who worshipped the Sun as their God may have been wiser than we have given them credit for. The earth would receive about one two-millionths part of the total radiant energy of the sun were it not for the fact that the atmosphere surrounding the earth prevents the passage of about a third of this amount.

The sun produces its greatest effect in the visible range. Probably not over two per cent of its radiation which reaches the earth is in waves longer than 28,000 A. U. The shortest waves reaching us under most favorable conditions do not go beyond 2,900 A. U. although the radiation *at* the sun itself probably extends to wavelengths as short as 650 A. U. The maximum intensity of sunlight is at 1 P. M. (not noon) and in the wintertime the intensity is much less and the days are about half as long so that during the winter

months barely enough U-V reaches our temperate zone to mention. Yet, if it were effectively used, and not wasted, or kept out as with ordinary window glass it is sufficient in volume to maintain health even through the shorter days.

The waves of greatest importance to optometrists include the infra-red rays, the light rays, and the VITAL section of the U-V rays. These latter rays are of such value and importance that another article under the caption "Vital Radiant Energy" is being prepared by the writer, and will soon appear in the pages of this Journal.

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NEW TERMINOLOGY IN OPTOMETRIC NOMENCLATURE

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Since many of us have finished our various training periods, some in the colleges and others in private offices, there has been inaugurated in the science of anatomy many new terms to supplement or take the places of the old ones. This new is called the International or B. N. A. Terminology and is the accepted standard of the world. It has been worked out by the anatomists to fit twentieth century needs and is used in all the new texts where anatomy is necessary and is taught in all the medical schools.

Arthur Robinson, M. D., F. R. C. S., Ed. Professor of Anatomy in the University of Edinburgh, and who edited the fifth edition of Cunningham's Text-book of Anatomy, says in the preface of his Manual of Anatomy: "The B. N. A. terminology is retained because:

1. It greatly reduces the number of terms used and lightens the student's work.

2. Most of the terms are 'sign-post' terms and are therefore instructive.

3. The terms indicating position make the definitions of relative positions simple and exact, and preclude ambiguity and misunderstanding.

4. It is used in the greater part of the English-speaking world, and in most continental countries."

I am sure that I can add nothing to this and that the optometrist who desires to keep abreast with the times will greet the new terms with a sigh of relief because of their exactness and simplicity. What does it mean to say Meibomian glands? Nothing, absolutely nothing. But when we say "tarsal glands" it has a definite meaning, namely, glands belonging to the tarsus. What does it mean to say internal and external recti? Surely not that one is within the bulb of the eye and the other without. Nor is one within and the other without the orbit. Neither is one internal and the other external to a logical starting point in relation to the eye. But to say "medial and lateral recti" means that one is medial to the middle line of the bulb of the eye and the other is lateral to it.

I look forward with keen anticipation to the time when the optometrist will become conversant with these terms and when they will be taught in the various schools of optometry. In order to make this article as impersonal as possible and to save the time of the reader, I have listed below the Latin and English translation, where

I was able to find or translate it myself, of the new International or B. N. A. terminology and the old. Let me recommend that the reader place this in a convenient place for reference and that he becomes familiar with its usage. These listed below are the ones that I deemed of interest to the optometrist and are taken from Cunningham's Textbook of Anatomy, fifth edition.

Latin	English	Old
bulbus oculi	bulb of the eye	eye ball
fascia bulbi	covering of the bulb	capsule of Tenon
sulcus sclerae	sclero-corneal junction	limbus
sclera	sclera	sclerotic coat
lamina cribrosa sclerae	sclerotic cribriform lamina	lamina cribosa
sinus venosus sclerae	sclerotic venous sinus	canal of Schlemm
epithelium corneae	corneal epithelium	epithelium
anterior elastica lamina	anterior elastic lamina	Bowman's membrane
substantia propria corneae	substance proper of the cornea	cornea proper
posterior elastica lamina	posterior elastic lamina	Descemet's membrane
excavatio papillae nervi optici	excavation of the papilla of the optic nerve	optic cup
hyaloid fossa	hyaloid fossa	patellaris fossa
spatia zonularia	zonular pace	canal of Petit
spatia anguli iridis	angular iris space	spaces of Fontana
commissura palpebrarum lateralis	lateral palpebral commissure	external canthus
commissura palpebrarum medialis	medial palpebral commissure	internal canthus
superior tarsus	superior tarsus	superior tarsal plate
inferior tarsus	inferior tarsus	inferior tarsal plate
glandulae tarsales	tarsal glands	Meibomian glands
rectus medialis	medial rectus	internal rectus
rectus lateralis	lateral rectus	external rectus
os zygoma	zygomatic bone	malar bone
ductus naso-lacrymalis	naso-lacrymal duct	tear duct

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OCULAR ELECTROTHERAPY

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CHAPTER V.

PHYSICS OF HIGH-FREQUENCY CURRENTS *(Continued)*

How High Frequency Current Is Produced

From a study of induction we know that an electrified body will cause electrical disturbances in other bodies near by when it is not visibly connected with them. The process of this disturbance is known as *induction.* While not very much is known about the process or exact mechanism of induction, much is understood of its general nature. If a coil of any kind with its terminals connected be brought into the vicinity of a conductor, through which an electric current is passing, there will not be any effect upon that coil or wire as long as the current is passing constantly. If the current passing the conductor be interrupted, a disturbance would take place in it and an electric current be set up in the approaching coil or wire. This is due to the fact that the sudden interruption of an electric current immediately causes a movement of electrons or a whirl of electrical stress called lines of force. The space occupied by the lines of force encircling an electrified body is called the *Electric Field.* Electrifiable material of any kind brought within this field becomes immediately electrified, and an electric current is set up, due to the movement of electrons, provided, however, that such material provides a closed circuit over which the electrons may pass. Such a current will soon cease to flow unless impressed by some means which will change these lines of force. The lines of force enter one end of a solenoid and pass out through the other, the same as in a bar of magnet. *A Solenoid,* which is a coil of wire wound in many turns, has the same properties as instead of a permanent magnet, it has a north and south pole.

The strength of the magnetic field of a solenoid depends upon two factors, (a) the number of turns of wire which make up the coil, (b) the strength of the current passing through the solenoid. By inserting an iron core within it, its power may be considerably increased. When the rate of the flow of current is increased, the lines of force will move away to a greater distance from the wire and when the flow of current is materially reduced, the lines of force will collapse on the wire.

The strength of a magnetic field of a solenoid can be regulated

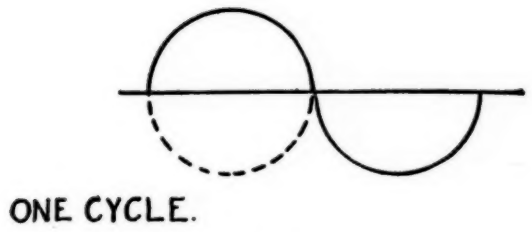

FIG. 4.

A cycle is compared to a circle. It is made up of two half circles representing two alterations, one positive and the other negative. (Eberhart)

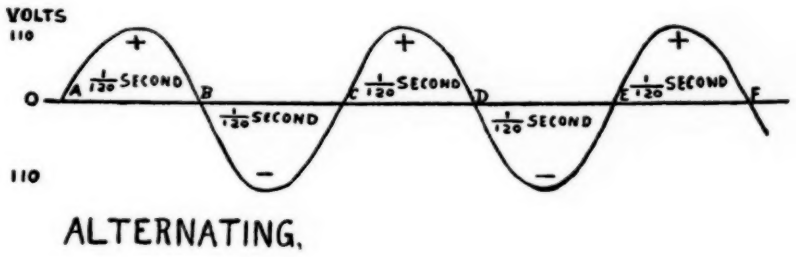

FIG. 5

This illustrates an alternating current. Here a wave starts at zero and moves up until it reaches its maximum positive voltage and drops down to zero again and then repeats the same process as a negative wave below the zero line. (Eberhart)

FIG. 6

This figure illustrates an oscillating current which is made up a series of diminishing wave which flows in opposite directions, alternating from positive to negative. (Eberhart.) To go with Chapter 4.

by the insertion of a coil of resitance wire in series with the windings of the coil.

An alternating current is to be used in the production of a high frequency current because the circuit carrying it has the property of inductance.

The low frequency current is converted to a high frequency current by raising the voltage. The usual 110 volt or 220 volt alternating current is put through a step-up transformer. This transformer is made up of a primary and secondary coil. The primary is formed by winding the wires leading from the street current around one arm of rectangular shaped core made of many layers of thin sheets of iron. These wires have no metallic connection with the iron; as a matter af fact, they are insulated from it. The insulations, as was explained in the previous chapter, have practically no effect in stopping the action of magnetic lines of force (induction) as it acts through all known insulators. On the opposite side of the core is wound the secondary. The wires of the secondary are also insulated from the core. There are only a few turns of heavy copper wire on the primary, while there are many hundreds of turns of small insulated wire upon the secondary. Fig. 7 illustrates the construction of a step-up transformer.

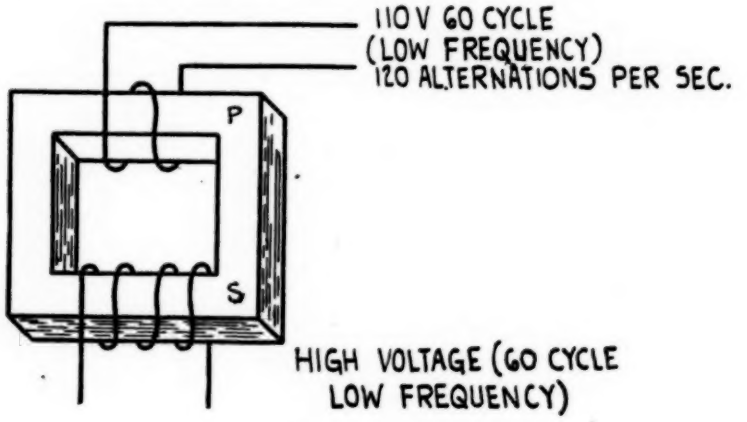

FIG. 7

Step-up Transformer. P—primary; S—secondary coil (Grover).

When a current of electricity passes through the primary coil, it causes immediately by induction a current to be set up in the secondary. The current in the secondary is an induced current. The voltage in the secondary is directly proportional to the ratio of wires between the primary and second coils. For example, if the primary coil has 100 turns of wire (the current being 110 volts), and the secondary 10,000 turns of wire, the current in the secondary will

have 100 times greater voltage than the primary. Thus, if the current supply in the primary was 110 volts the voltage impressed on the secondary will be 100 times greater or 11,000 volts. It is possible to produce a high frequency current of almost any desired potential by merely calculating the proper numbers of wire turns on both the primary and secondary coils, this in combination with a transformer, condenser and spark gap. The principle of the transformer may be applied both in raising and lowering the voltage. To raise the voltage the number of wire turns on the secondary coil is increased over the primary. To lower it the number of wire turns on the secondary is decreased in comparison with the primary. When the voltage is raised by means of a step-up transformer the amperage falls, and when the voltage is lowered by the use of a step-down transformer, the amperage is raised. *With every change of voltage there is a corresponding change in amperage.* Having an understanding of this principle, one is in a position to construct a transformer of almost any voltage or amperage. When the voltage is raised through the secondary of a step-up transformer, it is too dangerous to be applied for therapeutic purposes. A very good method of insulation becomes imperative for the safety of both the operator and patient. In order to enable us to utilize this high voltage, it must be converted into a high frequency current. The frequency should be raised to 10,000 or more oscillations per second, only then does it become safe to handle. Most of the machines produced now have a frequency ranging from several hundred thousands to several millions per second.

A condenser and spark gap are the other units of importance to be added in the process of producing high frequency current.

A Condenser is a device to store up electrical energy. It is composed of alternating sheets of metal and glass or other material having a high dielectric value. The function of a high potential condenser[22] in a set of high frequency, is to take the high tension current from the transformer, store it up until the "condensed" energy reaches a certain critical value, and then discharge the current across a suitable spark gap, thereby setting up electrical oscillations, which constitute a high frequency current. A condenser consists of two sheets of tin foil, separated by a sheet of paper. A condenser of this kind will have a certain electro static capacity designated by the word "microfarad" or a fraction or multiple thereof, all depending upon its size. A single sheet of paper with its foil coating will have a capacity of but a small fraction of a microfarad, and by placing a number of sheets of paper and tinfoil alternately in a pile and connecting the alternate leads from the foil in multiple, a condenser of any desired capacity may be built up, the capacity is increased in direct proportion to the number of little condensers connected in multiple.

This type of a condenser just described, while very simple, has this disadvantage, the sheets of paper placed between the tinfoil to

act as insulators or "dielectric" will not stand the strain if a high tension current were impressed upon it, and the paper would get punctured by the current. In order that the high voltage current may be used to store up a large amount of energy in a condenser, the dielectric must be made of some material possessing exceptionally good insulating qualities. Glass and mica are the best adapted for this purpose.

The condenser, as stated previously, discharges its load of stored up electric current across the spark gap.

A Spark Gap is composed of metallic electrodes, which have accurately turned faces held in the same plane by means of suitable supports. The electrodes are placed end to end and are insulated from each other. Provision is made for varying the distance between the electrodes. A large knob or disc of fibre enables the operator to make the necessary adjustments while the current is passing. In order that the heat generated by the spark may be dissipated, rotating discs are attached to the spark gap electrodes as seen in figure 8. The spark gap in a high frequency machine is of great

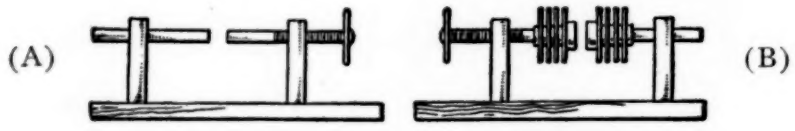

FIG. 8

A—Is a simple adjustable spark gap.
B—Is spark gap with a series of rotating discs attached to dissipate the heat generated by the gap (Strong).

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importance. The best machine with a poor spark gap[23] will prove to be most inefficient and even a machine well built with a good spark gap will be unable to deliver high frequency current if the electrodes of the gap are allowed to become oxidized and become dirty from being used too long without cleaning, and thus throw a permanent high resistance in series in the oscillation circuit. The current under these circumstances is reduced to a low frequency type and instead of being sedative in nature it becomes most irritating. The spark gap is the most important control of a high frequency machine and should at all times be given proper care, it will thus enable the machine to function efficiently. One must learn from sight, sound and subjective sensations of the patient, when the spark gap is too widely open. With a little practice one will learn just when the spark gap is too widely opened and will stop just a little short of the maximum amount, so that a nice even flow of current is evidenced by steady streams of sparks across the points. The meter needle will advance slightly each time the gap is opened a little wider and

finally will stop—waver or even fall back a little so as to register a lower milliamperage. Now, if by turning the gap down a little the meter needle will go up and register more current flow, we can then be certain that the gap had been opened too wide.

From a subjective standpoint the patient will complain of too much heat when the gap is opened too wide, this will be due to the faradic effect of the current. While it is important in the application of high frequency that the spark gap should not be opened *too wide* it is of equal importance that it should not be opened *too little.* For, if we open the spark gap too wide we use too much street current which shows a very high milliamperage on the meter, but this is of low voltage which is of little value from a therapeutic standpoint.

It is of extreme importance to have the current flow steadily and smoothly without any variations. There are numerous machines on the market with different makes of spark gaps. The machines having open spark gaps and which are so constructed as to enable to vary the distance between the points as well as to regulate the number of points used, are the most preferable. For they are equipped best to produce real sedative diathermy. In certain types of machines the spark gap does not remain clean very long and thus sets up a high resistance between the points. The current then becomes faradic and painful and the patient will complain of excessive heat. The use of these last mentioned type of machines is to be avoided.

Condenser Discharge

When the condenser is charged from the transformer, the charge according to Grover[24] is stored up on the plates of the condenser, this is known as an *electro-static charge.* The strain on the condenser is such that a spark jumps the gap allowing the current to flow through the inductance (solenoid) which sets up a magnetic field around the coil. The impressed force being thus removed, the lines of force collapse on the coil and allow the induced current resulting therefrom to flow back and recharge the condenser to the opposing polarity. The condenser now discharges across the gap in the opposite direction and is recharged from the transformer.

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A FEW NOTES ON SPECTRAL PHENOMENA IN ABSORPTION LENSES

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When applying the laws of refraction to lenses, the first consideration is generally given to dispersion, which accompanies refraction at all times. While the spectral colors can be divided into the visible and invisible classes, each of the rays will have the same velocity in air until they meet with resistance. As they reach a refracting medium, or a surface, because of the different wave lengths of the different colored rays, there occurs a breaking up of the white light into the various visible colors of the spectrum and the invisible rays. In considering the transmission of these rays through a lens, it is first necessary to note that many lenses are compounded in such a way as to either augment or destroy by absorption certain particular colors.

When analyzing a white ophthalmic lens, we find that approximately all colors of the spectrum are equally transmitted. While there is absorption of all the rays to a slight extent, for all refracting media absorb a certain small percentage, yet it can be seen that each colored ray has equal relative absorption, thus permitting the natural though slightly diminished sun rays to fall upon the retina. Observing the Soft-Lite Lens, the same phenomenon takes place, but with a higher absorption.

Under the present status, everything about us is highly polished, with the resultant complaints of photophobia, which can be prevented if not yet present, or corrected if already existing, in my belief, provided that the tinted lens prescribed permits the spectral colors to be transmitted in the same ratio as the incident rays entering the lens. It is, I also believe, very important that such a spectral ratio be maintained, as each wave length acting upon the retina has a significance in visual perception. To some extent, there is, due to the several refractions occurring through the surfaces and media of the dioptric system of the eye, also a recombination of colors into white, and if a disturbance of the ratio of these colors is produced, this recombination is hindered or even made impossible. Hence it is essential that the natural light reaches the eye, under this condition. Glare is not synonymous with excessive ultra-violet radiation. Whenever some men refer to glare, they almost always follow their statement by saying that it is the excessive ultra-violet ray present in the spectrum. This is contrary, I believe, to the true facts. Glare is excessive illumination; *i. e.,* too much radiant energy enters the eye, in comparison to the

ability of the rods and cones to produce the visual purple. This glare means that all colors under dispersion are excessive, not only the ultra-violet, which has a very short wave length, but also the violet, indigo, blue, green, yellow, orange and red.

In many instances, it is claimed that the eye distressing high reflection of rays from snow or sand, is due to the ultra-violet. Attempts have been made to counteract this painful condition with lenses absorbing more of the ultra-violet than of the visible colors. The same experiment was, I believe, conducted with another absorptive lens, which showed that when all colors, including the ultra-violet, were equally absorbed, greater comfort was reported by the subjects.

From this, it might be deduced that it is not the ultra-violet rays which are harmful but the excessive amounts of all radiant energy which causes the damage due to glare. My paper on "Glare in Visual Evolution" fully discribed how ultra-violet rays are I believe absolutely necessary for the growth of tissues and natural health thereof. Hence, I believe, when prescribing, one must be extremely careful not to cut out this important part of the spectrum. Under the present conditions of illumination, we have to contend with many types of glare, so that I believe all colors of the spectrum need to be proportionately reduced and the intensity of illumination cut down by means of an absorptive lens, which absorbs not only ultra-violet but also the visible spectrum.

Utmost care must, I believe, be exercised in considering the relief from or prevention of glare as it is a new problem, its seriousness first recognized only a few years ago. Originally, conditions show that the reason a tinted lens with the property of elimination of ultra-violet rays was of apparent benefit, is because such a lens also reduced the number of rays of all colors of the spectrum. However, while such lenses relieved the eye from glare, they also, in my belief, deprived it of all the healthful properties known to be in the ultra-violet.

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REPORT OF THE TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY.

Tuesday, December 6th, 1927, the American Academy of Optometry reconvened at the Hotel Pennsylvania, the Chairman, Dr. E. G. Wiseman, occupying the chair. Dr. Wiseman introduced Dr. R. M. Peckham.

VISUAL NERVE TRACTS

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Dr. Peckham stated his regret at having been unable to prepare a written paper for the conference, and that he would be compelled to speak extemporaneously. The following notes contain some of the salient features of his address:

In commenting on Dr. Woll's lecture concerning "The Evolution of the Eye," Dr. Peckham said that his statements relative to the development of perception in the primitive invertebrate, in infra-red light, and the successive stages of color perception, recognition of red evidently being the first in this evolution, were very important points. For, said the speaker, he had discovered that the use of red lights and red objects in the development of vision in an eye amplyopic ex anopsia, with red filtered out of the images presented to the better eye, is of extremely great value.

He further agreed with Dr. Woll that nature builds to meet requirements. In the last few decades, mankind has completely changed his environment and his ways of living. To meet these changes, and in adaptation of the body thereto, new functional developments are being evolved by nature. But, unfortunately, the change in our way of living has been more rapid than nature's methods of growth can keep pace with. So we find individuals striving to meet the demands of their daily work whose functional ability is inadequate. Especially is this true in the development of the function of convergence-accommodation. We meet scores of individuals lacking that full development of this, the highest form, the latest to appear, of the visual functions. Since today the larger part of our work must be done at the reading distance, it is essential that the convergence-accommodation be developed to its highest efficiency. And the innervational control of this function must be easy, unforced, well balanced.

Some accommodation is found in quite primitive animals, its

range and efficiency increase as the species ascend. Convergence appeared on the scene among the tree-living animals. Then, in the three higher types of apes, and later in man, appears what seems to be a third function, that of convergence-accommodation. It is more than an association between those earlier functions, accommodation and convergence, seems to be an independent function, an entity, complete within itself. The brain centers and the fiber pathways of this higher function are different than those of either accommodation or convergence.

We have been prone to attribute balanced binocular functionation to perfect muscular structure. Binocular imbalances have been attributed to faulty congenital muscular structure. But perfect musculature is hard to find, in any part of the body. In our own field, if we take a hundred enucleated eyes and lay them side by side, we shall find no two eyes with exactly the same muscular structure. There will be as many variations in the position and angle of attachment of the muscles of these eyeballs as there are eyeballs under observation. We may as well take it for granted that muscular structure is invariably imperfect. It is the way in which the individual compensates for his structural imperfections that counts, far more than the imperfection itself.

One person may have a very great congenial imperfection and compensate for it readily, with ease. Another may have very slight imperfections but either suffer the extreme of distress or so completely fail in the control of ocular functions that the error seems to be very great. We must always bear in mind that an improperly innervated organ presents all the aspects of a structurally imperfect organ. Very often, especially in cases of arrested, or incomplete, development of the convergence-accommodation function, it is easy, from our classical tests, to assume the cause of distress as structural, when in fact it is innervational.

There are few things more romantic, more fascinating, than the study of the development of the binocular functions. In essentials, there seems little difference between the act of a plant growing toward the light, of a flower turning to the moving sun, and the version of the eyes. And in the child, the beginning of the development of the versions is the attraction of a shining object. The neck versions of the moth are identical, in the chemistry of the afferent impulse, with the turning of the plant stem to the light. Loeb shows this beautifully in his work, *"The Comparative Anatomy of the Brain."*

The fish turns his body to bring his visual axis to bear on an object. The land animal turns his neck. The neck version preceded the eye version, but we humans retain the neck version as a subconscious reflex to widen the arc of the eye version. And some of us use the neck version more freely than we use the eye version. Such are those with low muscular mobility, as the esophore with his low ductions.

Here the speaker digressed for a moment, quoting Dr. George Lindsay Johnson as stating that the person who rotates his eyes freely prefers wide bifocal segments, while those who turn the head, using the neck versions rather than the eye versions get along very nicely with small segments. The question is: How are we to determine in advance which style of bifocal segment will be preferred? By experiment, Dr. Peckham said, he had found that those with poor eye versions and poor ductions would use the small segments, but those with free versions and high ductions were seldom pleased with narrow reading segments.

Another point brought out at this time was that those with poor eye versions and low ductions, who use the slow neck version instead of the swift eye version, are dangerous motor drivers. The esophore with 20/X vision, with all his energy directed to the convergence-accommodation and the maintenance of clear vision, with the ocular muscles thereby held in a state of semi-tetanus, is probably more apt to get into trouble at corners than the man of much lower vision but with free ocular motility and swift versions.

The only binocular version that is innate is the associated up and down rotation of the two eyes. In the horizontal versions, monocular excursions develop before binocular associations, and neck versions appear before binocular horizontal versions develop.

Binocular versions are the result of the semi-decussation of the optic fibers. In the fish, with his eyes at the side of his head, decussation is complete, all the optic fibers from the two retinae cross over to the opposite side of the brain. In the bird family, a few fibers remain on the same side, semi-decussation begins and the bird is the lowest animal with a neck version. As the species ascend, more and more of the retinal fibers are sent back to the brain hemisphere of the same side.

When did convergence first make its appearance? When the animals went into the trees. The earlier biologists stressed the importance, in the history of man's evolution, of the descent of the higher ape from the trees. Now, biologists sense that the ascent into the trees was of far greater import. So far as the development of binocular associations go, we have to agree with the modern thought.

The land animals had long noses, flat cheeks, eyes at the side of the head, the two visual fields either overlap very silghtly or not at all. There is no macula, though a few of the higher types of land animals do possess central retinal areas of slightly better vision than the peripheral fields.

The cat family went into the trees, began to look downward to watch enemies and get food. The eyes moved forward, the nose flattened, the cheeks developed, the smell sense commenced to dwindle and visual sense slowly superseded it. All these steps in upward progess we can study in ascending species and in the human foetus.

It seems that coincident with the development of the hand, with its reaching and grasping, is the development of binocular vision and its functions. Forward looking, the searching for fruit among the leaves, the replacing of a purely carnivorous diet with a partial or wholly vegetable diet, and the latter largely of fruits whose distinction among the leaves demanded the development of keener vision, this must have had its share in the development of a field of central sharp vision, in the appearance of the macula with its separate bundle of sensory fibers.

Dependence on the hand for locomotion among the tree branches, the development of the use of the hand for seizing food and conveying it to the mouth, replacing the lower animal's habit of seizing food in the mouth, of lip and tooth contact rather than paw seizure, this had its due share, no doubt, in the forward movement of the eyes, with overlapping of the two visual fields. And overlapping of visual fields demanded the development of single vision. So we find, in ascending species, more and more complexity in the criss-crossing of visual fiber pathways and of the motor pathways leading from cortical fields to ocular muscles.

Fish and bird are content with alternating monocular vision. The land animal must have simultaneous monocular vision. The rodent developed the vertical binocular association that he might look backward with both eyes at a pursuing enemy. The tree animal developed forward and down looking, a primitive form of convergence. And to this day, the vertical binocular association is innate in the human, the convergence act is an in and down rotation.

In this connection, there is an interesting observation from the study of embryology. It seems that the internal rectus and the inferior rectus are formed by the splitting of a single muscle. Whether this has any functional importance we do not yet know. We shall have to discover more about the fiber pathways over which these muscles are controlled. The details of these in the adult are unknown, much less their course and associations in embryonic forms.

When did the macula appear? Lindsay Johnson has shown that only three apes and man possess definitely developed maculae. He has also shown that only these four animals use the function of convergence, with its corollary of fusion.

Then there is the close association of the equilibrium function and the visual function, an interdependence and an intercontrol, with the equilibrium centers dominating the binocular rotations. Who shall say what influence the use of the hand in locomotion, the need for accurate placement of the image, had in the evolution of the single image of the needed binocular co-ordination?

Ocular versions are incited by the appearance of the image off the macula, by the need for clear vision, which awakens the reflex arc of ocular version to place the macula beneath the image.

Binocular versions of convergence are caused by the desire to place the two maculae beneath the two images. The result is fusion. Now there is some doubt as to whether we have not over-exaggerated the so-called fusional faculty, or the fusional impulse. There is very little direct evidence that the act of convergence is incited by "fusional desire." Fusion seems to be more of a result than a primary cause. The only evidence that we can at present adduce of a fusional desire is the abhorrence of diplopia, the mental distress of one who "sees double" after years of single binocular vision. And this evidence might fairly be said to point out that fusion is purely a psychic interpretation rather than mechanical act that it has been considered.

My experiments in stereoscopic vision, especially observations in stereoscopic moving pictures, give plenty of ground for the thought that possibly the fused image is in reality the swift mental imposition of alternating images. The images seem to alternate in spots, rather than as a whole. A deeper study of retinal rivalry ought to be made. It is a proper subject for very elaborate laboratory research. At any rate, I am inclined to think that our views of fusion need considerable revision and that a great deal of what has been said and written has been taken for granted rather than carefully proved.

Of fusional difficulties, or oddities, there is one most perplexing type, that I discovered in the fall of 1924. There are a great many people who fuse the peripheral images but do not fuse the foveal images. There are some who fuse the macular images but do not fuse the peripheral images at the same time. There are even some who alternate fusion of macular and peripheral images. It is a highly intriguing subject for investigation. When solved it may lead to some light on the problem of fusion itself.

Professor Ames and Dr. G. Gliddon, at Dartmouth, have likewise encountered this problem, particularly that type who fuses the peripheral images but do not fuse the foveal images. Professor Ames has denominated this peculiarity "Foveal Slip." This seems to have entirely escaped investigators in the past, though the cases are very common. There is no literature on the subject.

Nearly all the binocular imbalances that we have, I think mistakenly, called "muscle troubles," seem to originate largely in the misuse by the individual, of the convergence-accommodation function. Of course, we must except from this classification those imbalances arising from toxemias. As Bing, in his Text Book of *Nervous Diseases*, so well states it, "One of the first symptoms of toxemia is the loss of associated control of muscles that are normally synergistically innervated." We find these cases in plenty. I do not wish to discuss those hyperphorias, exophorias and esophorias that arise from toxic infection, further than to call attention to the fact that many cases are diagnosed as functional imbalances that are in reality toxic imbalances. It is often hard to discriminate between the two. And

sometimes both functional imbalances and toxic imbalances are present at the same time.

There are also imbalances arising from psychic, or mental disturbance. A very common type is esophoria among young women. This type is distinguished by large pupils. Accommodative esophoria, or esophoria caused by great exertions of the convergence-accommodation to give a clearly focussed image in compensation for considerable structural hyperopia, is characterized by rather small pupils.

For these esophoric young women with large pupils, it is a mistake to rely on plus lenses to repress the esophoria tendency. The headaches are not thereby stopped. Give plano base-in prisms for constant wear and you will find an immediate assuagement of the headache.

Here is another point on which we must revise our ideas. In our text books it is stated that pupillary contraction is an associate of accommodation. Text books on neurology contradict this. You find sentences something after this form, "It is now thought that pupillary contraction is an associate of convergence rather than of accommodation." In dissection, the pathway of the hookup of pupillary contraction with convergence was found, which caused that revision of opinion.

Now, with the recognition of convergence-accommodation as a distinct function, and with some knowledge, though it is yet but slight, we can see plainly that pupillary contraction is an associate of the convergence-accommodation function. Then, the size of the pupils becomes of as much importance to us in our diagnostic methods as it is to the neurologist in the diagnosis of psychic and visceral disturbances.

Convergence-accommodation is a highly individualistic function. It is not an innate function. It is developed by each individual, experientially. Some learn to use it well, just as they learn to do other things well. Some fail to develop the function. Others use it to excess, as the high latent hyperope with his 20/XX vision or better and the resultant semi-tetanic esophoria in his younger years and his high exophoria of exhaustion in later years.

Convergence-accommodation is an attention reflex. As a muscular act, it is incited by interest in the object whose image is refracted on the retina and relayed through the optic tracts and the external geniculate bodies to the cortical areas surrounding the calcarine fissure, in the occipital lobes. From these areas, the afferent disturbances seem to be relayed to the associative fields in the parietal lobes, whence, it is thought, spring the motor impulses that lead to the oculo-rotary nuclei. The pathway of these seems to be different from the pathways over which flow the impulses leading to versions.

Convergence alone, unassociated with accommodation must be considered as of the same type of muscular activity as the versions, direct reflex arcs incited by the sensation of the images off the foveas.

But convergence-accommodation is a psychic reflex arc. That vague thing that we call "Mind," about which we know nothing, enters into the problem.

Not only are the fiber pathways over which the motor impulses to convergence-accommodation different, to considerable degree, from those over which the less complex, more physical, less psychic, version acts are ordered, but the muscles calling for the convergence part of the act seem to be used in a different way.

In the versions, both lateral and vertical, the commands are directed through the 6th nuclei. Each 6th controls the voluntary 3rd of the opposite side and the 4th of the same side by strands of association, or connector, fibers. The right 6th is innervated from the left cortex, the left 6th from the right cortex.

When an image appears on the left sides of the maculae, both eyes turn to the right. When the image appears on the right sides of the maculae, both eyes turn to the left.

Touch the cortex of the left occipital lobe of a monkey with an electrode and both eyes turn to the right. Touch the cortex of the right occipital lobe with an electrode, both eyes turn to the left. I have performed that experiment. The farther from the median longitudinal fissure that one places the electrodes, the farther the eyes turn. Approaching the fissure with the electrodes, the less the eyes turn. With the electrodes on the mesial walls of the longitudinal fissure, there was very slight movement. With the electrodes deep in the fissure, at the point where the macular images are thought to be discharged, there was no movement. These areas are thought to be the motor fields of unconscious versions. That is, when we turn the eyes without deliberate thought, or subconsciously, in response to images appearing on the retinae outside of the foveas.

In the posterior part of the frontal lobes, pretty well down on the outer walls, there is another area where contact with electrodes will cause ocular version. This is thought to be the area of willed version. That is, when we consciously turn the eyes in some particular direction, just because we want to, though there is no image on the retina that would cause the eyes to turn.

For a long time it was thought, and the statement is still in some anatomies, that there was no motor field in the occipital lobes. But that the motor impulses were conveyed first to the frontal lobes, thence to the oculo-rotary nuclei.

But Sherrington proved that there are motor fields in the occipital lobes, with fibers leading to the 6th nuclei. He carefully cut, in a monkey, all the association fibers leading from the occipital lobe to the frontal lobe. Then he applied his electrodes to the area in frontal lobe and the eyes turned. He then applied the electrodes to the occipital lobes and the eyes turned. That would be an interesting experiment to repeat, but it requires more exacting knowledge of the fiber tracts than many possess.

When the impulse from the left cortex reaches the right 6th nucleus it is then relayed over three pathways. One to the right external rectus, pulling the right eye to the right. One to the right 4th nucleus, which transmits the impulse over the right 4th nerve to the left superior oblique, pulling the left eye to the right. Another to the left voluntary 3rd, which transmits it over the left 3rd nerve to the inturning muscles of the left eye, pulling the left eye to the right. Thus, both eyes turn together to the right.

The same things happen in the left 6th nucleus when the right cortex orders a left turning. The left 6th transmits the order through the left 6th nerve and relays through the left 4th and the right voluntary 3rd, so that both eyes turn to the left.

These fiber paths resemble somewhat the way the horseman drives a team. The reins are passed, attached to the bits, so that a pull with the right turns both to the right, a pull to the left turns both to the left. The crossing over of the middle reins is much like the decussating pathways from the 6th through the 3rd and 4th.

An auxiliary pathway runs down to the 11th nuclei, through which the neck muscles are innervated in association with the eye muscles, bring head turning into co-ordination with eye turning, increasing the range of our possible fields.

[This paper by Dr. R. M. Peckham, which is part of the Proceedings of the American Academy of Optometry, will be concluded in the June, 1929, issue.]—EDITOR, AMERICAN JOURNAL OF OPTOMETRY.

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DIRECT AND RED-FREE OPHTHALMOSCOPY

The most striking development of the last decade in the matter of clinical aids to diagnosis is the binocular opthalmoscope of Gulstrand. In this large clinical instrument the light from a linear intra filament, after passing through a condensing system, is reflected by a plate glass through one-half of the dilated pupil. Through the unilluminated half of the pupil the fundus is viewed by means of a binocular telescope. Since the unilluminated portion of the pupil is utilized, all corneal reflexes are eliminated. Owing to the telescopic arrangement, refractive errors introduce no disturbing variations, so that the fundus of a high myope, for instance can be viewed with perfect ease, and a stereoscopic view is obtained whose peculiar advantage is the accurate ability the examiner has to differentiate the various levels of the fundus when tumors, exudations and hemorrhages, and swellings of the optic disc are present. In using the Gulstrand ophthalmoscope the examiner can, by replacing the usual binocular telescope by a monocular eyepiece and a periscope, not only view the fundus himself, but can also show the image of the fundus, to another observer, obviously an ideal arrangement for a large clinic or school. This ophthalmoscope gives the examiner a magnification of from ten to forty diameters, this depending upon the possibilities of fixation.

It is not necessary, however, for the examiner to always use the Gulstrand ophthalmoscope. While this instrument is unquestionably the most refined diagnostic piece of equipment available of its kind,

the hand instruments, will when carefully used enable any examiner to carefully diagnose any changes from normal in the fundus or media. A good hand ophthalmoscope with a red-free attachment, preferably self-illuminated and controlled with a rheostat will, when properly used enable any optometrist to differentiate between the normal and abnormal fundus, between a clear and cloudy media and also enable him to examine the crystalline lens in sufficient detail for correct diagnostic work.

The writer is partial to the direct method of ophthalmoscopy, he believing the technique more sure and the application made with greater ease than by the indirect method. The technique of the direct method with a self-illuminated hand ophthalmoscope is as follows: The examiner first has the patient fix an object across the room. This object must lie on a level with the patient's eyes and a little to the nasal side of the eye to be examined. It is well for the examiner to place two small objects on the wall for the patient to look at; each object on a level with the patient's eye, and one so placed that it is on the right of the median line, the other so placed as to be on the left of the median line. This is done so that when the patient is viewing these objects, the examiner will find the patient's disc in such position that the examiner can see it with the ophthalmoscope, directly from the front.

To view the patient's right disc the examiner seats himself slightly to the right of the patient with the ophthalmoscope before his own right eye. The patient is then directed to look at the object on the wall which lies slightly to his left. The examiner now throws the light into the patient's pupil at a distance of six or eight inches and gradually approaches the patient, moving his (the examiner's) head slightly from side to side until the optic disc is visible. At first it will appear as a blurred white area, larger in size as a rule than the pupil through which you are looking. Holding this area in view and moving slowly still further forward, until one is within an inch or so from the patient's cornea, the examiner will find, in the normal eye the disc now in focus, or should he be unable to get it in focus by moving forward or backward he can now turn in the auxiliary lenses before the silvered mirror of the instrument, using either plus or minus until the disc is in focus, and the fundus becomes clear. In the normal fundus the arteries and veins stand out like well defined roadways on a map, the normal fundus area appearing orange-red in color. By viewing carefully one will note the arteries leading from the disc to different parts of the fundus and one will also note the larger appearing veins returning to the disc. These arteries and veins can be traced away from the disc and the entire fundus examined by having the patient look slightly up, then down, then in and then out. To view the macular area, the patient must be instructed to look straight in the mirror of the instrument, or else the examiner can have the patient view some object directly before the patient, while he approaches the eye slightly from the temporal

side, first finding the disc and later moving outward about a distance equal to the diameters of one and one-half discs. The later method is to be preferred, and while it takes some practice to satisfactorily find the macular area, once the examiner has accomplished this he will find his ophthalmoscopic diagnosis comparatively simple. Practice in ophthalmoscopy like in every other fairly difficult form of diagnosis, makes perfect and practitioners are urged to keep on trying and experimenting until the entire fundus can be carefully examined by him with ease. To examine the fundus of the other eye the procedure is naturally reversed, the examiner taking his place on the left of the patient, having him fix an object slightly to his right.

In the case of a patient having high myopia the examiner has found that by having the patient keep his correction in place while the ophthalmoscopic diagnosis is being made, assists the examiner in getting a clear view of the fundus. The writer prefers this method, in these myopic cases only, to that of turning minus lenses before the mirrored peep-hole of the instrument. Of course, this can only be done where the patient has large lenses and the examiner may also find it necessary to eliminate the reflected glare from the surface of the lens, to slightly tilt the glasses in the vertical meridian with his free hand.

We will now consider ophthalmoscopy with the red-free light. It is well to note first that normally the retina is transparent or at least practically so. The examiner when in throwing an ordinary beam of light on the fundus, finds that the light passes on through the retina to the choroid, and the image we call the normal fundus is more really a normal picture of the choroid with the retinal vessels, disc and slightly darker macular area resting upon it. Normally the retina itself cannot be seen, but should any defect be present, its diagnostic symptoms can immediately be discerned. In an effort to view the retina itself, two European scientists, Mayou and Voight by name, discovered, however, that the shorter waves of the spectrum do not have the penetrating power of the longer red waves, and consequently when used alone with the red rays excluded, the retina, instead of allowing the short waves to pass through, absorbs part of them, but reflects the greater part, thus itself becoming visible. The technique of red-free ophthalmoscopy is the same as that of direct ophthalmoscopy, its chief advantage being that abnormalities of the retina can more clearly be discerned, thus being particularly true in viewing the structures of the retina itself. For instance, in red-free ophthalmoscopy, the nerve fibers can be seen as white lines, and their arrangement, especially that of the arcuate juxta-papillary bundle can be readily followed. The technique is also of advantage in diagnosing early optic atrophy, as these nerve fibers will, in this disease, disappear entirely, yet no change will be noted when viewing the fundus through ordinary light. The macular area too, can be splendidly examined by means of red-free opthal-

moscopy, showing here in the normal eye a point of reflex at the fovea, with usually a halo, and sometimes a double halo around it. Duke-Elder claims that an absence of these halos denotes retinal pathology. The technique is of value also as many points of differential diagnosis are made clear. A papilloedema is differentiated from an optic neuritis by the swollen black capillaries and traces of white exudate on the disc in the latter, and by the wide separation of the fibers near the disc, the concentric folds around the disc, and the absence of exudate in the former. Atrophy of the retina is characterized in the early stages by the disappearance of the nerve fibers and the appearance of a marbled mattling; oedema by the separation of the nerve fibers and the loss or diminution of the foveal reflex or the reversal of its parallax. Secondary atrophy is distinguished from primary by the detection of exudates on the disc so small as to be easily passed over in ordinary light. Retinal hemorrhages are accurately localized, and disturbances of this tissue are clearly diagnosed from those of the choroid; the retinal pigment, for example, is quite distinct, while the choroidal is much less so, or altogether invisible. In general, the advantage of using red-free ophthalmoscopy is that much greater detail is secured than with ordinary light thus making your diagnosis much more accurate.

In viewing the fundus the examiner notes and should record for future reference, whether the disc is round, oval or elliptical in shape, pale, medium colored or dark rose-reddish in color with a broad, medium or narrow, clearly, just average or poorly defined edge, the tendency of the disc being to merge off towards the nasal or the temporal side. The cup is recorded as being small, moderate or large, it being easy or difficult to see and is either very deep, of average depth or shallow. The choroidal ring is recorded as showing on the nasal or temporal side, with any data relative to the scleral ring recorded should one show. The number and course of the retinal vessels are next recorded with a side notation on their pulsation, it being either moderate or marked. Data relative to the macular region is next recorded, it being easy or difficult to discern, the general color being pale, medium or dark with one or no small, medium or large bright foveal dot being visible. The general fundus color is next recorded it being either feeble, moderate or of the pronounced blond or brunette type. Following this notation any abnormalties which may have presented themselves are recorded, it frequently being found advisable to sketch certain abnormalties on one's record chart so as to be able to recall all of the important features of the fundus from one visit of the patient to another, and also to enable the examiner to note any changes which may have taken place between examinations. A few of the abnormal conditions of the fundus occasionally seen by the examiner are retinitis pigmentosa, choroiditis, retinal detachment, neuroretinitis and the condition of the disc and fundus peculiar to glaucoma. There are many other fundus abnormalities not mentioned here but those mentioned

comprise the majority most frequently seen. Let it suffice to say that patients suffering from abnormalities of this kind require special treatment. C. C. K.

INTERPRETING RESTRICTIONS OF THE COLOR FIELDS

In his new book on Visual Color Fields, Mendelsohn makes the following interesting claims regarding the restriction of color fields in perimetric diagnostic work. Mendelsohn finds that restrictions of the green field are caused by focal infections. By this he means that advanced cases of abscessed teeth or tonsils, sinus infections or other foci of infections will cause a restriction of the green field. He further finds that restrictions of the red field are caused by general systemic toxemia. By this he means that in those cases where the toxemia is becoming general or in other words affecting the entire system the red fields would be involved. The effects of chronic constipation is just one example of this. He also claims that involvements of the blue fields are caused by specific organic involvements, such as specific heart lesions or syphilis. Mendelsohn's findings are of material interest and if his contentions are substantiated in later investigations much of the uncertainty of perimetric diagnostic work would be eliminated. C. C. K.

BOOK NOTICES

OCULAR MEASUREMENTS. Albert Ames, Jr., Research Professor of Physiological Optics, and Gordon H. Gliddon, Research Fellow on Physiological Optics. Dartmouth College, Hanover, N. H. Published by the Section of Ophthalmology, American Medical Association. 68 pages. 55 figures. 15 tables. Paper covers. 1929.

This paper presented at the meeting of the ophthalmological section of the American Medical Association, held in Minneapolis, June 11-15, 1928, deals with a new method of ocular examination using a modified Peerless apparatus. The paper is in two parts, the first describing the equipment, the second its use and the deductions arrived at. The apparatus consists of a hinged T-shaped rack, the two lateral arms being movable and each carrying sliding target holders. The racks are graduated in centimeters and the arcs of rotation in degrees, to allow calculation of dioptric and vergence equivalents. At the center of the apparatus is a pair of half silvered mirrors, one before each eye, permitting the subject to see the reflections of mires on each side and also to see the third rack object directly ahead. A lens holder and head rest completes the instru-

ment. The test is wholly subjective, the observer relying entirely on the patient's answers. The mechanical accuracy of the apparatus and the method devised, greatly if not entirely eliminate the usual errors.

The various ocular functions tested by the examiners were as follows: 1. Accommodation at different distances. 2. Astigmatism at different distances. 3. Visual Acuity at different distances. 4. Horizontal Phorias at different distances. 5. Vertical Phorias at different distances. 6. Cyclodeclinations at different distances. 7. Amplitude of Accommodation. 8. Horizontal Fusional Amplitude at different distances. 9. Vertical Fusional Amplitude at different distances. 10. Cyclofusional Amplitude at different distances.

Distances at which tests were made were: Six meters, one meter, fifty centimeters, thirty-three centimeters, twenty-five centimeters, twenty centimeters. Variations were found with distances as for example in astigmatism, phorias, etc. For each condition observed graphs were made, being on the same scale they can be superimposed and a composite picture of the patient's ocular functions and condition is obtained at a glance.

As an example of the method, the procedure in measuring lag of accommodation may be briefly described; the mire of the median rack is adjusted for a certain distance, the axially movable racks are adjusted for the convergence equivalent. These side racks carry mires of pinhole light of a given type and are movable to and fro. When the patient or subject fixes the center mire, he sees the reflections of the two side lights fused as one. If confusion circles are noted the mires are slid along the racks until the lights are cleared up and sharply defined. The difference in reading between the center rack scale and the side racks scales gives the amount of lag.

The authors report that two full days were necessary to complete their first set of observations. Later through improvements the time was cut to three or four hours, and they are confident that further improvements in technique and instrumentation will reduce the time to one practicable with routine laboratory diagnostic work.

The authors argue that while the present elaborateness of the tests preclude their use in routine refractive work, their study will incite better and more detailed recording of ocular functions and point the way to new discoveries.

The authors incidentally pay particular attention to cyclophorias and to other conditions generally playing a very minor part in ocular examinations. In addition to the study of known ocular conditions, they believe they have discovered a new ocular condition hitherto undescribed, which they call "Retinal Asymmetry" and describe as an asymmetrical formation of the retina in one meridian, causing a heterophoria at the periphery while being orthophoric at the fovea. They do not believe the time ripe to fully expound their views and state that further apparatus and methods are being devised for similar

study. All in all the article is extremely interesting and presents a new and different outlook on the study of some ocular conditions.

Dr. G. L. DuPLESSIS.

A TEXT BOOK OF ACTINOTHERAPY. By Dr. D. D. Rosewarne. Published by C. V. Mosby Co., St. Louis, Mo. 237 pages, 20 illustrations including one colored plate. 1928. Price $4.00.

Rosewarne in writing the text book of Actinotherapy has constantly kept in mind the students' point of view, although at the same time the book will be helpful as a review to the practitioner.

The subject-matter covers the field of actinotherapy very completely, at the same time the author used the most simple style, which makes it easy for the reader to grasp all of the essentials of this interesting subject.

The book is divided into three parts. In the first part which consists of nine chapters, the author describes the physical and chemical action of light, discussing fully the constitution of matter, radiant energy, the electro magnetic spectrum, electrical phenomena and the different types of therapeutic lamps.

The biological action of light, its influence upon living organs; the skin, the blood, etc., is discussed in the second part which is made up of four chapters.

The third part of the book which takes up thirteen chapters describes the clinical procedure in the application of actinotherapy to specific cases.

The book is well written and upon reading it one gets a clear conception of the subject of actinotherapy without wandering off into the realms of physics or metophysics. J. I. K.

ABSTRACTS

THE ILLUMINATION OF TEST CHARTS. W. H. Crisp. Editorial. American Journal of Ophthalmology. Vol. 11, No. 11, pp. 910-912. 1928.

Crisp in an editorial on the subject of Illumination of Test Charts claims that Mr. R. S. Burnap, an illuminating engineer, and Dr. E. C. Jackson an ophthalmologist, recommend a standard of one hundred to one hundred twenty-five-foot candles for the illumination of test charts for ordinary sight testing. This incidentally is much higher than that suggested by most authorities.

T. O. B.

NOCTURNAL VISUAL ACUITY. Worms and Beyne. Report of French Society of Ophthalmology, May 16, 1928.

"Aviation requires of its night flying followers clear visual definition in illumination of reduced intensity." This power of definition is measured in terms of visual acuity. Other factors being constant, visual acuity is dependent upon the angle subtended by the object seen, the illumination of said object and lastly, the adaptation of the observing retina to the degree of illumination the object is subjected to.

G. Worms and J. Beyne have sought to evaluate nocturnal visual acuity, using the average man as subject. The procedure was as follows:

1. Men of twenty years of age and of average visual acuity were selected.

2. Landault's rings were used as test type, in sizes appropriate.

3. They employed degrees of illumination comparable among each other both as to quality and quantity. This illumintaion was more exactly artificial and of constant progression when produced by electric currents of definite potentials and diminished to known extents by means of the new photometric glasses of Tscherning.

4. The selection of an illumination physiologically comparable to that of a clear moonless night and entirely void of secondary or parasitic illumination from other sources than the illuminant. This was found to be of about 0.0015 lumens.

Their deductions were as follows:

With the aforementioned illumination, nocturnal visual acuity of normal young men is about 6 to 9% of daytime visual acuity, between 20 and 65 years of age it diminishes in direct ratio to the increase in age. In ametropes nocturnal visual acuity is sometimes low, especially in hyperopes and astigmats.

It was also deducted that in sound normal subjects, there is bewteen the most and the least favored a difference of 33% in visual acuity.

The authors conclude that there is no relation between diurnal and nocturnal acuities and that the higher efficiency in nocturnal visual function of certain individuals would seem to predispose them for nocturnal occupations, such as piloting, such selection being founded on acuity and speed of adaptation.

G. L. DuP.

ANNOTATIONS AND SOCIETY PROCEEDINGS

The American Journal of Optometry is the official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

The following gentlemen have consented to supply items of interest from their respective sections, acting in the capacity of

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MINNESOTA'S NEW OPTOMETRY LAW

On Saturday, April 27, 1929, Governor Christianson signed the Amendments to the Optometry Law of Minnesota, making this new law the most remarkable piece of optometric legislation on the statute books today. In the first place, this new optometry act contains that outstanding public health feature known as the "Glazed Goods Amendment." This amendment, which will do so much to save the eyes of America, prohibits the sale of glazed goods within the confines of Minnesota. The amendment as now included in the optometry law of this state is similar to that of New York which was recently upheld by the United States Supreme Court.

In addition to the foregoing amendment, to protect public health, the new optometry law of Minnesota has several new clauses of interest—first—the Board is given wide and unusual powers to enforce the law and to prosecute various types of violation which from time to time may occur; second—the law specifically prohibits "price advertising" of professional services, and—third—the law specifically prohibits "free eye examination" advertising, both types being held untruthful.

Thanks must be given to Dr. A. H. Nordland of Minneapolis, Dr. Ernest H. Kiekenapp of Faribault, and Dr. Jos. Frank of New Prague, for assisting the members of the House and Senate in drawing up these amendments and explaining their value to the members

of both houses. To Dr. Nordland particularly the State Association is deeply indebted as it was necessary for him to spend much time away from his office in the handling of these new amendments.

* * * * * * *

SUGGESTS STUDY ON GLARE

Mr. N. Singer, prominent manufacturer of optometric material has offered to finance, for a period of time, a research fellowship on the subject of Glare, this work to be done under the auspices of the United States Public Health Service at Washington, D. C.

Mr. Singer contends that glare is not a natural element in light, in the proportion we find it today. It comes, he claims, from the introduction of complexity of color and intensity of brilliance in modern environment, and in artificial light. Bright colors he finds cause violent glaring reflections. Billboards, various shaded buildings, show windows, wearing apparel, automobiles, theatres—everything today being alive with color thus aggravating this condition.

Mr. Singer's proposal of a "Chair on Glare" in the U. S. Public Health Service, is now being discussed at Washington. He also recently conferred with the largest manufacturer of lighting appliances on the subject of glare-control in illumination.

* * * * * * *

UNIVERSITY OF ROCHESTER

Through the joint co-operation of the officers of the University of Rochester, the Bausch and Lomb Optical Company and the Eastman Kodak Company, an Institute of Optometry is steadily developing in that University. At the present time, University Courses in Optometry and also in Applied Optics are being given, and a new course in theoretic optometry is now being planned. This newly created institute will occupy the entire top floor of the John J. Bausch—Henry Lomb Physics Building, adequately equipped for the purpose. This building represents a gift of $300,000 to the University, paid by members of the Bausch and Lomb families.

* * * * * *

THE A. O. A. CONGRESS

A committee in charge of the exhibits at the coming convention of the American Optometric Association, week of June 17th, announces that twenty-six manufacturers of optometric material and instruments have arranged to display their supplies at the convention which will be held in Philadelphia.

Dean Fitch of the Pennsylvania State College of Optometry is in charge of the educational activities for the coming convention, a complete program of which will shortly be published.

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OKLAHOMA CONVENTION AND CLINIC

Dr. M. S. Gregory, Mr. M. F. Hollister, Dr. W. J. Heather and Dr. Roy S. Dean conducted a series of lectures and clinics before the Oklahoma Association of Optometrists, at its Twenty-fourth Annual Convention. New officers elected to serve the Association for the following year are as follows: Dr. E. B. Rose, President; Dr. C. H. Beavers, Vice-president; Dr. E. B. Alexander, Secretary and Treasurer. In addition to the clinics and lectures, the annual optometric golf tournament was held, the cup for this year being won by Dr. B. R. Hubbard of Swanee, Oklahoma. Dr. W. S. Farmer of Oklahoma City reports that the convention was very successful and claims that many new technics of value in their practices were demonstrated.

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ILLINOIS CHAPTER BETA SIGMA KAPPA

On March 15th a meeting was held at the Congress Hotel, Chicago, Illinois, for the purpose of organizing an Illinois chapter of Beta Sigma Kappa, to be known as the Chi chapter of Beta Sigma Kappa. Dr. B. B. Dickson was elected President, Dr. W. Ervine, Vice-president, Dr. G. W. Regan, Secretary, and Dr. Robt. J. Scollay, Treasurer.

* * * * * * *

DISTRICT OF COLUMBIA SOCIETY.

Dr. Geo. T. Warren was elected President of the District of Columbia Society, at their annual business meeting held on April 2nd. Other officers are Dr. M. A. Leese, First Vice President; Dr. E. H. Etz, Second Vice President; Dr. E. H. Silver, Secretary, and Dr. S. J. Dantzer, Treasurer. The next meeting of the society will be held on May 6th. Dr. S. Whitman will be the speaker.

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PITTSBURGH OPTOMETRIC ASSOCIATION

"The Perimetric Research Work of Brombach" and the "Ryer Technic in Myopia" will, according to Dr. H. T. Lewis, Secretary of the Pittsburgh Optometric Association, be the subject to be discussed at a three day clinic, conducted by Dr. A. M. Skeffington, in Pittsburgh, on May 1st, 2nd and 3rd.

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BETTER BUSINESS BUREAU AGAINST MAIL ORDER GLASSES

At the request of the Bureau, Mr. Guy A. Henry, director of the Eye Sight Conservation Council, prepared a paper on "Selling Glasses by Mail, and Mail Courses in Eye Treatment." Papers were also prepared for the Bureau by the National Society for the Prevention of Blindness on these subjects: "Selling Glasses by Mail," "Throw Away Your Glasses—Fallacy," and "Tinkering with the Eyes." In his article, Mr. Henry points out the impossibility of fitting eyes correctly through the mail with ready made glasses. The other articles ex-

pose the quacks who advocate that people throw away their glasses and give them really nothing as a substitute. In general the articles stress the importance of proper eye care for people whose eyes are defective. The better Business Bureau is to be encouraged and congratulated in its attempt to help eradicate the existing evils.

* * * * * *

NEW JERSEY ACADEMY OF OPTOMETRY

Dr. C. Heintz was elected President of the New Jersey Academy of Optometry at its recent meeting. Other officers are Dr. Milton J. Stark, Vice President; Dr. Philip Jackman, Secretary and Treasurer. At this same meeting Dr. J. Fred Andreae, Secretary of the American Academy of Optometry, was made an honorary member of the New Jersey Academy.

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COLORADO STATE CONVENTION

The annual convention of the Colorado State Optometric Association will, according to Dr. J. C. Bloom of Denver, be held at the Shirley-Savoy Hotel in Denver, Colorado, on June 4th. Colorado optometrists are urged to attend this meeting as a well balanced educational program is being arranged.

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A NATION WRIT

FOUR months ago the profession accepted the Orthogon Lens—on faith. They said, in effect, "We know the Orthogon principle is correct, the plan for service is excellent—and it is a product by Bausch & Lomb." Whether this faith would be vindicated by the test of experience, only time would tell.

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The reaction of every section to the Orthogon Lens is given separately and in detail in the following pages.

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